DEFENSE INFORMATION SYSTEMS AGENCY

JOINT INTEROPERABILITY TEST COMMAND
FORT HUACHUCA, ARIZONA

NORTEL VOICE OVER SECURE INTERNET PROTOCOL ENCLAVE INTEROPERABILITY ASSESSMENT REPORT

JULY 2008

(This page intentionally left blank.)

NORTEL VOICE OVER SECURE INTERNET PROTOCOL ENCLAVE INTEROPERABILITY ASSESSMENT REPORT

JULY 2008

Submitted By:

Joseph Schulte
Chief
Network Systems Branch

Approved By:

for RICHARD A. MEADOR
Chief
Battlespace Communications Portfolio

Prepared Under the Direction of:

Rodney Alexander
Joint Interoperability Test Command
Fort Huachuca, Arizona

(This page intentionally left blank.)

EXECUTIVE SUMMARY

The Defense Red Switch Network (DRSN) provides secure telecommunications for Command and Control crisis management. The mission of the DRSN is to support voice and conferencing requirements of the senior Department of Defense, civil, and Allied decision-makers within the subscriber community. As an adjunct to the DRSN, the Defense Information Systems Agency (DISA) has pursued an initiative that supports the implementation of Internet Protocol (IP) Telephony on the Secret Internet Protocol Router Network. This initiative is referred to as Voice over Secure Internet Protocol (VoSIP) which provides IP to IP calling between user enclaves and interoperability with the DRSN.

The Space and Naval Warfare Systems (SPAWAR) Command in coordination with the DISA DRSN Program Manager's Office requested the Joint Interoperability Test Command assess the interoperability between the DISA VoSIP initiative and a Nortel VoSIP enclave. The objective of the assessment was to determine the ability of the Nortel enclave subscribers to place inter-enclave IP calls and to establish calls to DRSN subscribers. Basic telephony features and the ability to implement policy-based Nortel enclave subscriber access to the DRSN were also tested. Multilevel Precedence and Preemption (MLPP) and directory services were not tested during this assessment due to known issues with proprietary implementations of signaling and directory services. JITC conducted the test at the SPAWAR Systems Center in Norfolk, Virginia in accordance with the DRSN Program Manager's (PM) "VoSIP Core/Enclave Interoperability Test Plan" dated July 2007.

Test results showed that there were no interoperability issues between Nortel subscribers and DRSN subscribers; however, there were three issues noted between Nortel and Cisco subscribers:

- Caller Identification (CID) (caller name and full number) did not work to its full extent when calls were placed from a Cisco to a Nortel enclave; only last 4 digits of call originator were displayed on the Nortel phone. When a subscriber called from the Nortel enclave to a Cisco enclave/core, the caller name and 10 digit number of call originator were displayed on the Cisco phone, which was the desired outcome for CID.
- there was no ring back on a call transferred between subscribers within Nortel and Cisco enclaves (a discrepancy in basic telephony), and
- Nortel subscribers could not use the flash-hook feature of the Nortel switch to connect two Cisco subscribers (although this feature was not specifically called out in the test plan, it still demonstrates a discrepancy in basic telephony features).

These discrepancies pose a minor risk to interoperability between these two vendors on the VoSIP network. Overall, there is a high degree of interoperability among the Nortel enclave, the Cisco enclave/core, and the DRSN.

(This page intentionally left blank.)

TABLE OF CONTENTS

Page

EXECUTIVE SUMMARY i

SYSTEM FUNCTIONAL DESCRIPTION 1

TEST BACKGROUND 1

TEST PURPOSE 1

SCOPE 1

METHODOLOGY 2

RESULTS AND ANALYSIS 2

CONCLUSION…… 4

APPENDICES

ACRONYMS A-1

SOFTWARE VERSIONS AND CONFIGURATION DIAGRAM B-1

REFERENCES C-1

POINTS OF CONTACT D-1

LIST OF FIGURES

B-1 VoSIP Enclaves to DRSN through Cisco Core Gateway Test Setup B-3

LIST OF TABLES

1 Nortel Enclave VoSIP Testing 2

(This page intentionally left blank.)

SYSTEM FUNCTIONAL DESCRIPTION

The Voice over Secure Internet Protocol (VoSIP) interface to the Defense Red Switch Network (DRSN) provides a secure means for authorized users to integrate Voice over Internet Protocol networks to the DRSN through existing Secure Internet Protocol Router Network (SIPRNet) circuits. The VoSIP project is implemented under strict control by the DRSN Program Manger (PM). The VoSIP core gateway consists of a suite of Cisco IP telephony devices, Cisco Call Manager (CCM), Cisco Local Area network (LAN) equipment, Cisco border router, and an IP to Time Division Multiplexing (TDM) gateway that interfaces to the DRSN through a serial T1 Channel Associated Signaling (CAS) trunk (see Figure B-1). The Cisco VoSIP enclave consists of Cisco IP telephony devices, Cisco Call Manager (CCM), and Cisco switch LAN equipment (see Figure B-1). The Nortel VoSIP enclave consists of a Nortel Call Server, Baystack switch and Cisco border router (see Figure B-1). The core gateway routes calls to the DRSN using CCM software. VoSIP enclaves connect to the VoSIP core gateway over cryptographic links. This allows a phone with the proper calling area classmarks to call into the DRSN via the core gateway.

TEST BACKGROUND

The Navy is currently using the Nortel Call Server and Nortel Voice over Internet Protocol (VoIP) equipment as its VoIP solution. The Space and Naval Warfare Systems Command (SPAWAR), in conjunction with the Defense Information Systems Agency (DISA) DRSN PM's office, requested the Joint Interoperability Test Command (JITC) assess the interface between a Nortel enclave and the DRSN through a Cisco core gateway. The interoperability between the Nortel enclave and the Cisco enclave was also part of this assessment request.

TEST PURPOSE

To determine the degree of interoperability among a Nortel VoSIP enclave (instantiated as part of the DISA VoSIP), a Cisco enclave, and the DRSN via the VoSIP Core Gateway.

SCOPE

The assessment setup simulated the current network setup for VoSIP (see Figure B-1). The setup consisted of a DRSN Digital Small Switch Version 2 (DSS-2) connected to a VoSIP core gateway with a T1 CAS trunk. A Nortel enclave and a Cisco enclave were networked to the core through a Cisco border router. Each Cisco enclave and the core had three phones attached that were set to the three different class partitions. The Nortel enclave had four phones attached, two of which were setup as class "A" phones, while the other two were class "B" and "C" respectively. The class partitions restricted calls from a class "C" phone to its own enclave, a class "B" phone to within the VoSIP network, and a class "A" phone is able to call anywhere within the VoSIP network and the DRSN. The DSS-2 had three phones with no restrictions. Call

restrictions must function on all VoSIP cores and enclaves, and are a requirement to attach to the DRSN.

The test plan for this assessment was developed and approved by the DRSN PM's office. The objective of the test plan is to determine the ability of the Nortel enclave subscribers to place inter-enclave IP calls, to establish calls to DRSN subscribers, to test basic telephony features and the ability to implement policy-based Nortel enclave subscriber access to the DRSN.

METHODOLOGY

The test was conducted 04 through 05 March 2008 at the SPAWAR Systems Center in Norfolk, Virginia. A total of fifty-four calls were placed between the Nortel and Cisco enclaves and the core gateway to evaluate call reliability, voice quality, and class "C" call restrictions. Fifty-four calls were also placed to the DSS-2 from the two enclaves, and the core gateway to evaluate call reliability, class "B", and class "C" call restrictions.

Test calls were made to and from the enclaves, the core gateway, and the DSS-2 to test call hold, call waiting, call transfer, pre-answer call transfer, progressive conference, preset conference, and meet-me conference features. All features were evaluated on call completion, call indications, and signaling.

The ability to test the exchange of caller identification (ID) or automatic number identification (ANI) between the IP/VoSIP domain and the DRSN could not be assessed over a CAS T1 trunk. The T1 CAS trunk connects by exchanging a series of setup pulses over the same channel the voice will traverse. This is called in-band signaling. Caller ID and ANI data require a separate data channel, which CAS does not support, for call setup in order to pass the more complex data. This is called out-of-band signaling.

Directory Services and Multi-Level Precedence and Preemption (MLPP) were not tested during this assessment. While the equipment is capable of performing MLPP functions DISA will not implement it until Real Time Services features, such as Resource Reservation Protocol and Assured Service - Session Initiation Protocol (AS-SIP) are operational. Proprietary methods of accomplishing Directory Services, which are currently implemented within the VoSIP network, make it impossible to share directory information between vendors at this time.

Appendix B provides the software versions of the tested equipment and test network setup diagram Figure B-1.

RESULTS AND ANALYSIS

There were three issues identified during testing, which are noted in Table 1 below and discussed in the following paragraphs.

Table 1. NORTEL Enclave VoSIP Testing

Step	Type of Calls	Calls Attempted	Calls Completed	Notes
1	Station to station calling between Cisco and Nortel Enclaves with Class C call restrictions	18	18	Pass[1]
2	Station to station calling between the Cisco Enclave and Cisco Core with Class C call restrictions	18	18	Pass
3	Station to station calling between the Nortel Enclave and Cisco Core with Class C call restrictions.	18	18	Pass[1]
4	Call on hold while placing second call between Cisco and Nortel Enclaves.	4	4	Pass[1]
5	Call on hold while placing a second call between Cisco Core and Cisco Enclave.	4	4	Pass[1]
6	Call on hold while placing second call between Cisco Core and Nortel Enclave.	4	4	Pass[1]
7	Call waiting between Cisco Core and Nortel Enclave	4	4	Pass
8	Call waiting between Cisco Core and Cisco Enclave.	4	4	Pass
9	Call waiting between Cisco and Nortel Enclaves.	4	4	Pass
10	Call transfer between Cisco Core and Nortel Enclave.	4	4	Fail[2,3]
11	Call transfer between Cisco Core and Cisco Enclave.	4	4	Pass
12	Call transfer between Cisco and Nortel Enclaves.	4	4	Fail[2,3]
13	Conference call between Cisco Core and Nortel Enclave.	4	4	Pass
14	Conference call between Cisco Core and Cisco Enclave.	4	4	Pass
15	Conference call between Cisco and Nortel Enclaves.	4	4	Pass
16	Station to station calling between Cisco Core and DRSN with Class B and C restrictions.	18	18	Pass
17	Station to station calling between Nortel Enclave and DRSN with Class B and C restrictions.	18	18	Pass
18	Station to station calling between Cisco Enclave and DRSN with Class B and C restrictions.	18	18	Pass
19	Call on hold while placing second call between Cisco Core and DRSN.	4	4	Pass
20	Call on hold while placing second call between Nortel Enclave and DRSN.	4	4	Pass
21	Call on hold while placing second call between Cisco Enclave and DRSN.	4	4	Pass
22	Call waiting between Cisco Core and DRSN.	4	4	Pass
23	Call waiting between Nortel Enclave and DRSN.	4	4	Pass
24	Call waiting between Cisco enclave and DRSN.	4	4	Pass
25	Call transfer between Cisco Core and DRSN.	4	4	Pass
26	Call transfer between Nortel Enclave and DRSN.	4	4	Pass
27	Call transfer between Cisco Enclave and DRSN.	4	4	Pass
28	Conference call between Cisco Core, Nortel Enclave, and DRSN.	6	6	Pass
29	Conference call between Cisco Core, Cisco Enclave and DRSN.	6	6	Pass
30	Conference call between Cisco Enclave, Nortel Enclave, and DRSN	6	6	Pass
31	Preset conference launched from the DRSN including Cisco Core, Cisco and Nortel Enclaves.	1	1	Pass

Table 1. NORTEL Enclave VoSIP Testing (continued)

Step	Type of Calls	Calls Attempted	Calls Completed	Notes
32	Meet-me conference originating on Cisco Core.	6	6	Pass
33	Meet-me conference originating on Nortel Enclave.	6	6	Pass
34	Meet-me conference originating on Cisco Enclave.	6	6	Pass

Legend:
DRSN – Defense Red Switch Network

Notes:
1. Caller Identification (caller name and full number) did not work to its full extent when calls were placed from the Cisco Enclave/Core to the Nortel Enclave, only 4 digits were displayed on the Nortel phone, while there was no issues with caller identification when calls were placed from the Nortel Enclave to the Cisco Enclave/Core.
2. When a call was placed from a Cisco subscriber to a Nortel subscriber, or from a Nortel subscriber to a Cisco subscriber and the call was transferred to another network subscriber via transfer button, there was no ring back received on the originating phone after the transfer was initiated and prior to the call being answered (pre-answer transfer). When calling from a Nortel enclave or Cisco enclave phone over the Cisco core gateway to the DRSN switch the ring back was transferred to the originating phone. Standards for this type of call transfer require that the signaling, including ring back, be transferred to the originating phone, so this step is considered failed.
3. When a Nortel Enclave subscriber places a call to a Cisco Enclave/Core subscriber, then places the Cisco subscriber on hold, then places a second call that properly connects to another Cisco subscriber, and then utilizes the transfer feature on the Nortel phone to connect the Cisco subscriber that is on hold with the Cisco subscriber that has an active connection, the call transfer fails. This call scenario was not specifically identified in the test plan, however it has been identified as an interoperability issue.

The DRSN PM requested VoSIP subscriber access to the network be restricted by class partitions, allowing calls into the DRSN only from designated phones. These call restrictions were setup in the enclaves and core, and were tested during the initial station-to-station calling test. Call restrictions operated correctly on both enclaves and the core gateway.

There were no interoperability issues between Nortel subscribers and DRSN subscribers; however, there were three issues noted between Nortel and Cisco subscribers, which are discussed as follows.

1) When calls were placed between Nortel subscribers and Cisco subscribers, Caller Identification (CID) (caller name and full number) did not always work to its full extent. When a call originated from a Cisco subscriber to a Nortel subscriber, only the last 4 digits of the calling party were displayed on the Nortel phone. When call originated from a Nortel enclave subscriber to a subscriber in a Cisco enclave/core, the Cisco subscriber phone displayed the expected CID; name of call originator and their 10-digit number. The source of this issue, either switch configurations or different switch implementations of IP signaling protocol, is unknown and was not researched due to time limitations during the test window.

2) When a call was placed from a Cisco subscriber to a Nortel subscriber, or from a Nortel subscriber to a Cisco subscriber and the call was transferred to another network subscriber via transfer button, there was no ring back received on the originating phone after the transfer was initiated and prior to the call being answered (pre-answer transfer). When calling from a Nortel enclave or Cisco enclave phone over the Cisco core gateway to the DRSN switch the ring back was transferred to the originating phone. Standards for this type of call transfer require that the signaling,

including ring back, be transferred to the originating phone, so this step is considered failed.

3) The “VoSIP Core /Enclave Interoperability Test Plan” requests a call placed from the Cisco core to the Nortel enclave be transferred from the Nortel enclave to another phone on the Cisco core. This step passed as written, but when the first call originated on the Nortel enclave to the Cisco core, that call was put on hold, and a second call was placed to another phone on the same Cisco core, the Nortel phone would not release the second call when the transfer icon was selected keeping the two Cisco phones from connecting; therefore the transfer would not take place. This failure occurred whenever both calls originated from a phone on the Nortel enclave, and both calls were placed to either the Cisco Core or Enclave.

CONCLUSION

The objectives of the assessment were to determine the ability of the Nortel enclave subscribers to place inter-enclave IP calls, to establish calls to DRSN subscribers, to test basic telephony features, and test the ability to implement policy-based Nortel enclave subscriber access to the DRSN. Based on these objectives testing showed there is a high degree of interoperability demonstrated between subscribers in the Nortel Enclave, the DRSN, and the Cisco Enclave/core. There were no interoperability issues between Nortel subscribers and DRSN subscribers; however, there were three issues noted between Nortel and Cisco subscribers that pose a minor risk to interoperability between these two vendors on the VoSIP network.

(This page intentionally left blank.)

APPENDIX A

ACRONYMS

ANI	Automatic Number Identification
CAS	Channel Associated Signaling
DISA	Defense Information Systems Agency
DRSN	Defense Red Switch Network
DSS-2	Digital Small Switch Version 2
ID	Identification
IP	Internet Protocol
IST	Integrated Services Telephone
JITC	Joint Interoperability Test Command
KG-194	Trunk Encryption Device
LAN	Local Area Network
MLPP	Multi-Level Precedence and Preemption
PM	Program Manager
SIPRNet	Secret Internet Protocol Router Network
SPAWAR	Space and Naval Warfare Systems Command
STE	Secure Telephone Equipment
STU-III	Secure Telephone Unit Third Generation
TDM	Time Division Multiplexing
VoIP	Voice over Internet Protocol
VoSIP	Voice over Secure Internet Protocol

(This page intentionally left blank.)

APPENDIX B

SOFTWARE VERSIONS AND CONFIGURATION DIAGRAM

DRSN DSS-2
-Switch Software version 8.02.01

Core Gateway

Cisco Call Manager CCM 7825
- Windows 2000
-Call Manager Software Version 4.2(3)

Cisco 3745 Gateway Router
-Software Version 12.4

Cisco 3550 Switch
-Software Version 12.1

Cisco 2600 Border Router
-Software Version 12.3

Cisco Enclave

Cisco Call Manager CCM 7825
- Windows 2000
-Call Manager Software Version 4.2(3)

Cisco 3550 Switch
-Software Version 12.1

Nortel Enclave

Nortel Call Server Meridian 1000
-Call Server Software Version 4.5

Baystack 460 Switch
- Software Version 3.6

Cisco 2600 Router
-Software Version 12.1

(This page intentionally left blank.)

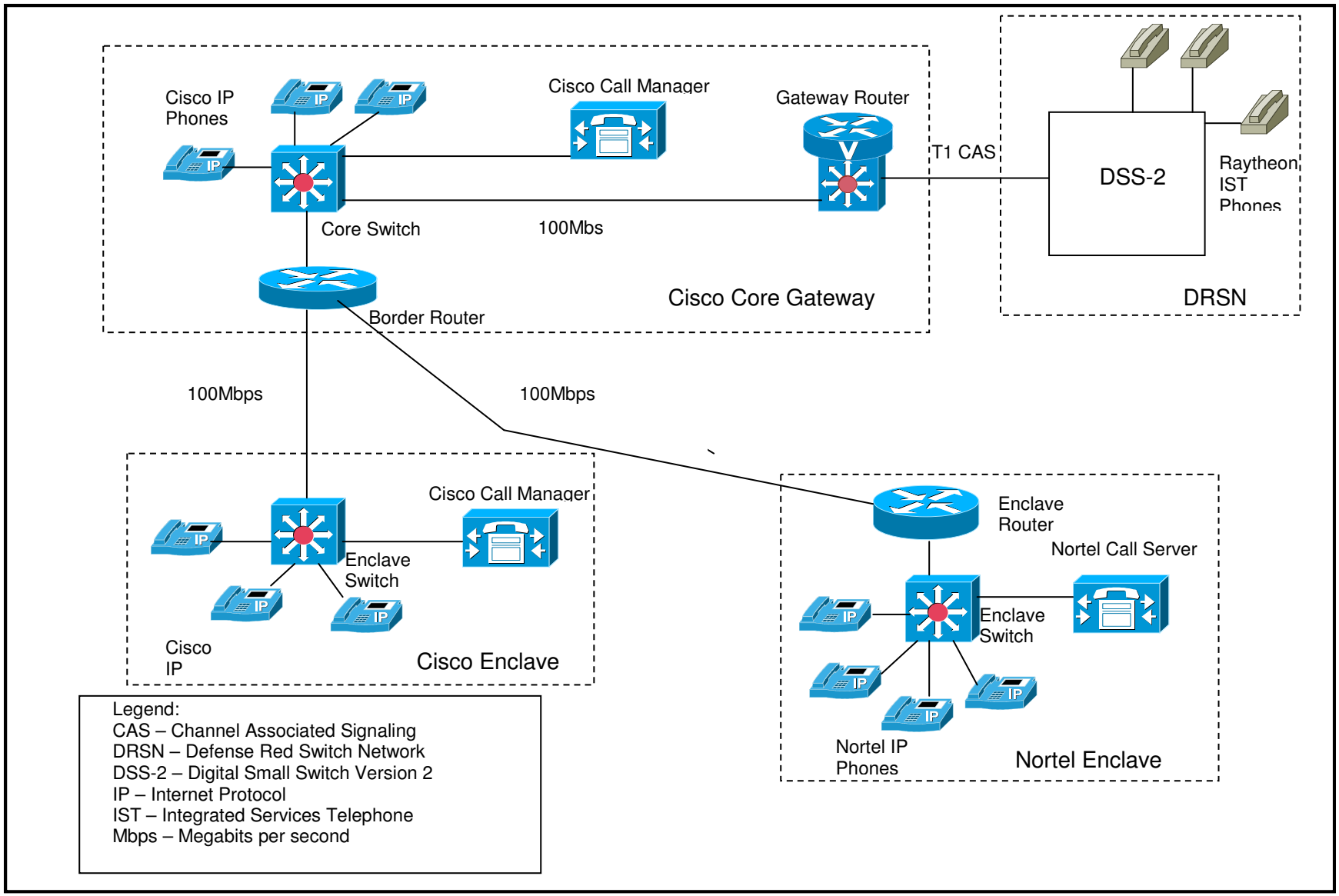

Figure B-1. VoSIP Enclaves to DRSN through Cisco Core Gateway Test Setup

(This page intentionally left blank.)

APPENDIX C

REFERENCES

JITC Publication, “Defense Red Switch Network Generic Test Plan,” May 2003

Defense Information Systems Agency Secure Voice Division, GS24, “VoSIP Core/Enclave Interoperability Test Plan,” July 2007

Defense Information Systems Agency, “Defense Red Switch Network (DRSN) System Description”, May 1996

(This page intentionally left blank.)

APPENDIX D

POINTS OF CONTACT

DISA DRSN Program Manager	Mr. Robert McLaughlin	DSN: 381-0344
Chief DISA Secure Voice Branch	Ms. Maria Medina	DSN: 381-0317
SPAWARSYSCEN DRSN Coordinator	Mr. Michael Hendricks	DSN: 578-5263
JITC Test Director	Ms. Anita Bickler	DSN: 879-5018
JITC DRSN Testbed Supervisor	Mr. David Baum	DSN: 821-8124
JITC Test Conductor	Mr. Alan Claytor	DSN: 879-5430
DISA Test Conductor	Mr. Terry Whaley	CML: 520-559-3574

(This page intentionally left blank.)